Perception of farmer towards climate change and associated proposed agriculture strategies

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Abstract. Climate change is widely acknowledged as a prominent obstacle that significantly impacts agricultural productivity and the well-being of individuals. Farmers bear the brunt of the impact since they must consistently adapt to changes in climate. Questionnaire surveys were conducted in Bhopal, India to ascertain farmers' perspectives of climate change and its implications. The research was conducted out in Bhopal, Madhya Pradesh. M.P. possesses a range of meteorological conditions, soils, and a variable cropping pattern. This study utilises cross-sectional household survey data collected from farmers residing in Bhopal. The study employed a multi-stage sampling process to choose respondent houses for the sample. Ultimately, the study's sample size was established at 97 household heads. The study employed quantitative data. Data collection was conducted using household surveys. The researchers employed both structured and unstructured questionnaires to examine the farmers' impression of climate change. Given the nature of their work, researchers asked the farmers who took part in it what they thought about climate change. The findings imply that a variety of factors, including age, level of learning, and prior agrarian expertise, influence farmers' perceptions of global warming.

Keyword-: Agriculture, global warming, climatic conditions, strategies, hypothesis

1 Introduction

Climate change and changes in this natural occurrence will have a severe impact on farmers, particularly those in rural areas of poverty, lowering agricultural productivity and their level of economic well-being [1]. Due to its heavy reliance on water, soil, and other natural assets, farmland is extremely susceptible to weather and climate. In certain areas, climate change

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can allow for numerous crops or a longer growing season, but it can also make certain practices more challenging. Farmers' ability to adapt and cope with the pace and extent of change will determine how climate change affects them. American agriculture already uses adaptable practices.

Various parts of the country may experience better or worse growing conditions for crops as a result of climate change. For instance, lengthier growing seasons are a result of variations in temperature, precipitation, and frost-free days in practically every state. For food production, a prolonged growing season can offer both advantages and disadvantages. Certain farmers may be capable to grow longer-maturing crops or several crop cycles, whereas other farmers may require more irrigation during a longer, warmer season for growth. Air pollution can harm forests, plants, and agriculture as well. Farmers must realize and accept the existing or projected change in the climate, and they must accord sufficient weight to such recognition, in order to drive them to take adaptation measures. In the last few years, there has been a developing collection of literature examining farmers' viewpoints on climate change. Nevertheless, not much research has been done on this subject [6].

Information, beliefs, attitudes, and concerns related to the existence and nature of climate change are among the psychosocial factors that influence how we perceive climate change [7]. The perception of oneself is influenced by a number of factors, including one's traits, one's previous experiences, information received, and one's cultural and geographical surroundings [8]. Therefore, assessing how climate change appears and identifying its underlying factors is a challenging task."

In order to distinguish between typical short-term fluctuations and indications of climate change [9], it is difficult to distinguish daily, seasonal, and yearly variations in local weather patterns. The development of beliefs about climate change is often driven more by short-term fluctuations in local conditions than long-term patterns, making them more noticeable and significant [10]. Although farmers and others whose income is dependent on the weather tend to understand weather conditions better than others, they may still struggle to interpret significant changes that warrant concern or action.

Life experiences shape perception, and those who have personally encountered severe climatic catastrophes often perceive a higher likelihood of similar occurrences occurring again [12]. Moreover, the way an individual perceives climate change can be impacted or altered by the information they receive. Perception is somewhat subjective, meaning that individuals in the same area may have varying impressions of climate change despite experiencing the same weather patterns [13].

Over the course of human history, farmers have adjusted their practices to suit evolving environmental, social, and economic circumstances. However, it remains uncertain whether agricultural producers will be able to match the unprecedented rate at which climate change is projected to occur in the upcoming years [14]. Agricultural farmers that rely on rainfed agriculture, lack access to financing and insurance, and are unconnected from regional or national markets would experience more pronounced adverse consequences from these changes [15]. To mitigate these adverse consequences, it will be necessary to implement public policies and initiatives that encourage and support adaptation. However, farmers must possess knowledge about climate change in order to be willing to undertake adaptation strategies. Climate change perception affects farmers' decisions both regarding planting and adaptation strategies [16]. To formulate and effectively execute agricultural adaptation plans, it is necessary to understand farmers' perspectives on climate change.

2 Climate Impact on Agriculture

With climate change, agricultural soil qualities are being affected by environmental stresses including salt, drought, and temperature swings. These pressures endanger agricultural ecosystems and threaten food availability worldwide by affecting physiological reactions, efficiency, and yield of crops. Pharmaceutical pesticides and fertilizers exacerbate the degradation. The effects of the changing climate on farming and the livelihoods of farmers are known to the Indian government. According to field and simulation research, rainfed rice yields in India are expected to decline by 20% in 2050 and 47% in 2080 scenarios if adaptation initiatives are not implemented. The yields of rice grown under irrigation are expected to decline by 3.5% in 2050 and 5% in 2080. In 2050, wheat yields are expected to decline by 19.3%, and in 2080, by 40%. Droughts and other extreme weather events have an effect on farmers by affecting food and nutrient intake. Establishing a predictive system for weather data, enhancing human flexibility, and fortifying systems for agricultural production are required stages to accomplish this. Adverse hydrologic incidents, such as flooding and droughts, have spiked by 60% in Europe in the previous thirty years due to climate change. Floods and dry conditions account for more than 70% of the US's drop in cereal yields, demonstrating the direct impact these natural disasters have on crops and agriculture. Given the complexity and unpredictability of the soil circumstances, variations in soil moisture are essential to crop growth and production [19]. The Indian government has pledged to use shorter varieties, neem-coated urea, alternating soaking and drying out, and other methods to reduce methane emissions in lowland rice fields by 40–50%. Using dry direct seeding, emissions of methane can be cut by 70–75%. Additionally, the nation is increasing the retention of carbon by using crop wastes, organic manure, and nutritionally balanced soil [20]. Examining how climate change affects Vietnam's agricultural industry, this study in [21] finds that Vietnam's productivity in agriculture is adversely affected by global warming. Vietnam's agricultural productivity and economy are positively impacted by CO2 emissions, land, and fertilizer, and negatively impacted by rainfall and labor. The report offers policy suggestions to assist Vietnam in mitigating the adverse consequences of the changing climate on its economy while advancing environmentally friendly growth and the reduction of poverty.

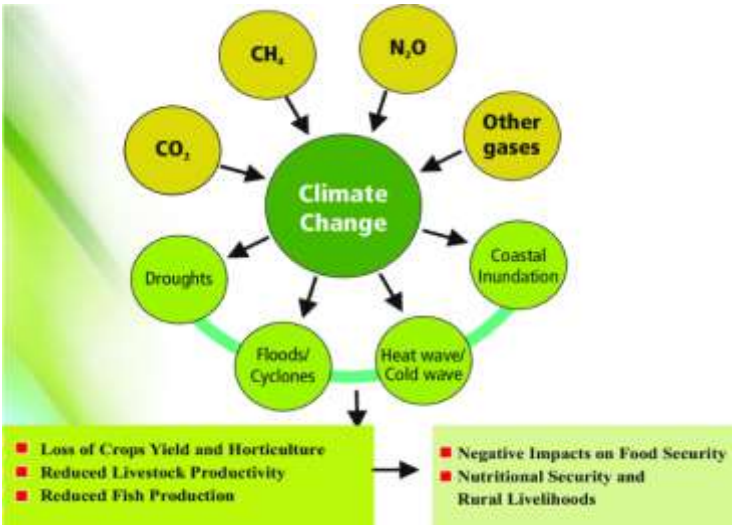

Fig.1: Climatic change in agriculture

Under future climate circumstances, the study in [22] evaluates how well sustainable agriculture methods reduce sediment and nutrient export to rivers. With a maximum level of sedimentation export depletion of 65% and a maximum nutrient export depletion of 35%, filter strips had a strong mitigating impact. The greatest depletions came from employing numerous sustainable measures, with 35% of nutrients exported and 71% of sediment exported being depleted. The ORANI-G-SL model, which was employed in [23-28] to investigate how climate change is affecting agricultural productivity in Sri Lanka, shows that lower crop yields will raise consumer prices, which will therefore cause food insecurity. The present study highlights the necessity of conducting additional research on adaption techniques to climate change as well as policy responses to mitigate the negative impacts on food as well as and agricultural production in South Asia. The availability of food, economic growth, and global life all depend on the agriculture industry [29]. Climate change, however, poses a threat to this industry and has an effect on food delivery, preparation, manufacturing, and usage. It emits greenhouse gases, which also adds to global warming. Fruits are important for the supply of food, but they also have a big impact on the release of greenhouse gases, agricultural land use, and freshwater extraction [30]. This research in [31] investigates how digital agriculture technology can lower greenhouse gas emissions, boost output, and guarantee food security. Food security has suffered as a result of climate change, which has lowered cattle output, slowed animal growth, and reduced crop harvests [32]. The report emphasizes the need for more equitable distribution, higher yields, efficient agricultural food systems, decreased environmental damage, and a decrease in malnutrition [34]. It does, however, highlight the necessity of coordinated efforts by researchers, farmers, and governments to reap the sustainable and equitable benefits of digitalization.

3 Research Method

3.1 Study Area

The research was carried out in Bhopal, Madhya Pradesh. M.P. possesses a range of meteorological conditions, soils, and a variable cropping pattern. The land area is now split into 11 agro-climatic zones as a result. M.P. has had substantial advancements and growth in agriculture during the past few decades [35-37]. The output of food grains has increased by almost 100%. Regarding food grain output, it ranks second only to U.P. and Punjab. It accounts for 7.7% of the overall food grain output in India. Madhya Pradesh, with producing 24% and 25% of the total pulse and oil seeds output in India respectively, holds the top position in the country [38].

Fig. 1: Study area Bhopal

Wheat has become a prominent agricultural commodity in Bhopal. The wheat cultivation area in 2018-19 amounted to 125,216 hectares. The "Sharbati" kind of wheat is the highest quality form of wheat that can be found in the nation. Sharbati wheat is cultivated extensively in the region [39-40]. The region possesses a dark and alluvial fertile soil that is well-suited for cultivating Sharbati wheat. Sharbati wheat, also known as The Golden Grain, derives its name from its golden colour, substantial appearance, and sweet flavour [41]. The Sharbati type of wheat is characterised by a subtle sweetness in taste, perhaps due to its relatively high content of simple sugars such as glucose and sucrose, distinguishing it from other wheat varieties. Madhya Pradesh has a plentiful supply of Sharbati wheat in several districts, such as Sehore, Narsinghpur, Hoshangabad, Harda, Ashok Nagar, Bhopal, and the Malwa areas [42].

3.2 Survey methodology

The research utilizes data gathered from a cross-sectional household survey conducted among farmers residing in Bhopal. Employing a multi-stage sampling approach, households were selected as sample respondents for the study. Ultimately, the study's sample size was established at 97 household heads [43-46]. The study employed quantitative data. Household surveys were used to acquire primary data. The researchers employed both structured and unstructured questionnaires to examine the farmers' impression of climate change. The farmers who were polled were asked about their impression of climate change among farmers. Data were analysed using the SPSS20 programme. The connection between different factors was analysed using t-test and ANOVA. The acquired data was analysed using both descriptive and inferential statistical approaches [47-49].

4. Results and Discussion

4.1 Demographic Profile

Table 1: Demographic

Variable	Respondent, %
Gender	
Male	76(78.35)
Female	21(21.65)
Age	
25-35	17(17.53)
36-40	33(34.02)
Above 40 years	47(48.45)
Education	
Primary	39(40.21)
Secondary	58(59.79)
Farming experience	
1-3	18(18.56)
3-5	31(31.96)
Above 5	48(49.49)

Table 1 indicates that 78.25% of farmers are male, while 21.65% are female. In terms of age distribution, 17.53% of farmers belong to the 25-35 age group, 34.02% fall into the 36-40 age bracket, and 48.45% are above 40 years old. Regarding education, 40.21% of farmers

have received primary education, whereas 59.79% have attained secondary education. Analyzing farming experience, 18.56% of farmers have 1-3 years of experience, 31.96% have 3-5 years, and 49.49% have more than 5 years of experience in farming.

4.2 Hypothesis testing

T-test-: Table 2 shows that the t-value for the comparison between male and female farmers regarding perception is 4.267, which is statistically significant at a threshold of significance of 0.05. Hence, there is a notable disparity between male and female farmers in terms of their view of climate change.

Table 2: Descriptive statistics and t-test for different styles about gender

	Gender	N	Mean	Std. Deviation	t-value	p-value
Perception towards climate change	Male	76	1.586	1.036	4.267	0.000
	Female	21	2.132	0.739		

ANOVA

Table 3: ANOVA for age

		Sum of Squares	df	Mean Square	F	Sig.
Perception	Between Groups	60.887	3	15.222	16.45	0.000
	Within Groups	85.092	93	0.925		
	Total	145.97	96			

Table 4: ANOVA for education

		Sum of Squares	df	Mean Square	F	Sig.
Perception	Between Groups	69.287	3	17.322	15.826	0.000
	Within Groups	100.692	93	1.094		
	Total	169.979	96			

Table 5: ANOVA for farming experience

		Sum of Squares	df	Mean Square	F	Sig.
Perception	Between Groups	101.297	3	23.324	41.834	0.000
	Within Groups”	55.692	93	.605		
	Total	156.990	96			

Based on the Table 3, 4 and 5, it is cleared that perception towards climate change was differ with respect to age ($F=16.45$, $p<0.05$), education ($F=15.82$, $p<0.05$) and farming experience ($F=41.83$, $p<0.05$). Therefore, there exists a notable disparity in the perception of climate change, which varies according on age, education, and agricultural experience. The age of farmers can influence their perspective of climate change. Elderly farmers may possess a substantial reservoir of expertise and conventional wisdom on regional climatic trends and agricultural methodologies. Climate change perception may be influenced by individuals' comparisons of current weather phenomena with their past experiences. The media portrayal

of climate change and scientific data may, however, be more affecting to younger farmers. The implication of climate change on agricultural activities may also be more acute for individuals with a longer time frame and a greater sense of apprehension.

In understanding and understanding climate change, farmers' education can be very influential. The scientific concepts underlying climate change and their possible ramifications on agriculture are likely to be better understood by farmers with high levels of education. Scientists, extension services, and agricultural organizations are most likely to gather and understand climate-related information. As farmers become more educated, they will be able to adopt climate-smart farming techniques and technology.

The firsthand experiences farmers have with weather fluctuation and extreme events could influence their views on climate change. According to experienced farmers, climate change may have amended weather patterns, altered growing seasons, or accentuated extreme weather events as a result of altered weather patterns and climatic conditions. With the passing of time, seasoned agriculturalists become more attentive to climate change as a result of being exposed to this phenomenon. As a result of the lack of farming experience or due to their inexperience, farmers with little knowledge of climate change may not be as aware of climate change as those with a great deal of experience or those who have found it difficult to observe significant changes in weather patterns because of this.

5 Conclusion

Variation and mitigation strategies rooted in local conditions are urgently needed to deal with the consequences of climate variation on agriculture, as per the farmers' perceptions of climate fluctuation. Depending on demographic elements, along with age, pedagogy and exposure, farmers in Bhopal, Madhya Pradesh, perceive their livelihood in another way. A tailored conversation and intervention approach is needed to address those variations. Biostimulants are organic substances, microorganisms, or mixtures of the two that have the ability to control the molecular changes as well as the physiological, biochemical, and anatomical aspects of plant growth behavior. Because bioactive substances differ in composition, their mechanism of action is unique and they operate through a variety of mechanisms. A policy guide, a pedagogy-based application, and records access will even empower farmers to adopt adaptive measures more successfully. With the global network handling climate variation, these studies can be used to expand techniques that enhance food safety and agricultural livelihoods. A complex and uncharted area, weather change impacts on agriculture require collaboration among governments, researchers, and farmers. it's miles imperative that collaboration and innovation be fostered with the intention to make sure a sustainable and resilient agricultural future.

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